



Understanding Adhesive Characteristics for Wearables Design and Development

There are many challenges engineers face when developing a wearable device. Extended wear time is one of the most challenging requirements. The skin is a complex substrate which has many requirements—especially when extended wear times can sometimes be as high as 30 days. For these long-wear applications, adhesives not only need to be able to maintain their bond to the skin, but must also manage moisture, be breathable, and fit the users lifestyle requirements, like showering and exercising.

There are four major material characteristics to consider in the performance of any wearable device adhesive. These include:

- **Static shear** — The ability to hold in position in the presence of shearing forces, such as bending and twisting movements. This is also known as cohesion.
- **Peel** — The ability to resist removal by peeling. This is also known as the level of peel adhesion.
- **Tack** — The ability to adhere quickly. For example, some pressure-sensitive adhesives may adhere almost instantly, whereas others may need to be held in place with some light pressure for a short time to achieve optimal securement.
- **Moisture management** — The ability to move moisture, such as perspiration and other bodily fluids, away from the patient's skin to avoid discomfort and irritation. Moisture is typically managed in one of two manners, either through fluid absorption (being absorbed and contained within the material) or moisture-vapor transmission (evaporating through tiny pores in the material). The latter is measured by the moisture vapor transmission rate (MVTR).

The performance of a given adhesive depends on its type, formulation and the material it is coated on, or what is more commonly known as the carrier. Different adhesive types inherently have certain properties, for example, acrylic adhesives coated onto breathable carrier materials can provide a strong hold while also remaining comfortable for the user. Soft silicone adhesives (SSAs) are inherently gentle and used in applications that require atraumatic removal. Though they are gentle, they are not inherently breathable and do allow for moisture transmission. They can be manufactured with perforations to facilitate air flow and moisture to pass through. They can also be formulated with a higher tack to provide stronger bonding for wearables.

Some characteristics can be specifically engineered into the adhesive based on the specific formulation, coat-weights and carrier materials used. It is important therefore, given the large amount of variety, that an engineer works closely with an adhesive materials manufacturer to determine the right adhesive for their particular application and end-user needs.

Reference: 1. Prakash, Deepak. "Designing Wearables: How to Make Sense of Your Material Options." Medical Design & Outsourcing, 9 Mar. 2018. www.medicaldesignandoutsourcing.com/designing-wearables-material-options/.

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